UNIVERSITY OF ALBERTA

Four Piano Recitals and an Essay:

Timbre and Instrumental Specificity as Structural Elements in Modernist Musical Composition

by

Roger James Admiral ©

A Thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Doctor of Music

DEPARTMENT OF MUSIC

EDMONTON, ALBERTA

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Abstract

In the course of the twentieth century, modernist composers have come to recognize timbre and instrumental specificity as vital determinants for compositional methodologies. In the resulting work of many composers, qualities inherent in a musical instrument, such as timbre and sound production, emerge in the foreground of musical texture and are equal in importance to elements such as pitch, duration and dynamic level. In this essay I examine different manifestations of timbre and instrumental specificity shown through composers' attitudes towards orchestration and through selected recent musical examples involving piano and percussion instruments. My objective is to consider both compositional approach and musical notation, and the different ways in which the two deal with timbre and instrumental specificity.

The essay is divided into two parts. The first part traces an historical and contextual background to the topic, in the course of which the evolution of orchestration, the growing trend towards highly differentiated timbral organization, and the development of electroacoustic music are discussed. The chosen examples suggest that, historically, associating instruments with affects or symbolism in support of a text is gradually replaced by a more abstract experimentation with instrumental combination, tone color and timbral organization.

The second part of the paper examines specific musical examples showing different types of instrumental specificity. In his piano work *Territoires de l'oubli* Tristan Murail utilizes resonance of partials from the overtone-series to generate compositional

structure. The use of amplification as a process in exploring the microlevel characteristics of an instrument's sound potential is exemplified in works of Karlheinz Stockhausen, Alvin Lucier, John Cage and David Tudor. Traditional Western art music instruments' ontological status, their historically stereotypical use and the fetish of beautiful sound inform the dialectic of Helmut Lachenmann's *Allegro sostenuto*.

The conclusion examines different ways in which composers attempt to notate timbre. Electroacoustic composers, working with recorded sound, give the aural facet priority over the written. This aesthetic contributes to electroacoustic music's integrity as being purely timbral composition.

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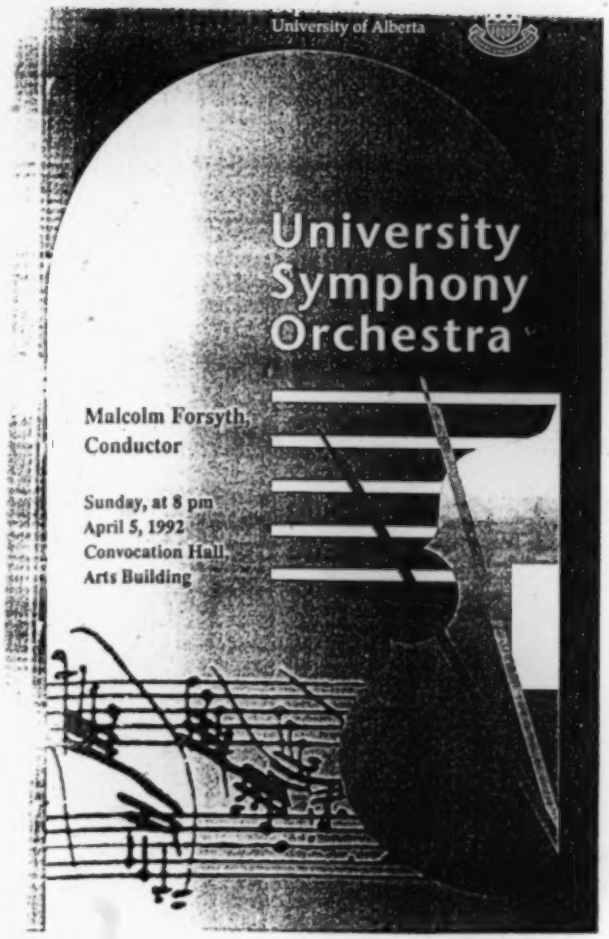

Program:

El Salon Mexico (1933-36) — **Aaron Copland** (1900-1990)

Concerto for Piano and Orchestra in A minor, op. 54 (1845) — **Robert Schumann** (1810-1856)

Allegro affettuoso
Intermezzo
Allegro vivace

Roger Admiral, pianist

Intermission

Symphony No. 2 in D, op. 43 (1901-02) — **Jean Sibelius** (1865-1957)

Allegretto
Tempo Andante
Vivacissimo
Allegro Moderato

Chamber Music Recital

ROGER ADMIRAL, piano

Monday, March 15, 1993 at 8:00 pm

PROGRAM

Stille Tränen, Op. 35, No. 10 (1840)
Die Blume der Ergebung, Op. 83, No. 2 (1850)
Lied der Suleika, Op. 25, No. 9 (1840)
Widmung, Op. 25, No. 1 (1840)
Mein schöner Stern!, Op. 101, No. 4 (1849)
Aufträge, Op. 77, No. 5 (1850)
Volksliedchen, Op. 51, No. 2 (1840)
Röselein, Röselein!, Op. 89, No. 6 (1850)
Die Stille, Op. 39, No. 4 (1840)
Mondnacht, Op. 39, No. 5 (1840)

Robert Schumann
(1810-1856)

Kathleen Lotz, soprano
Roger Admiral, piano

Nocturne (1993)

Roger Admiral
(b. 1965)

The Hammerhead Consort
Roger Admiral and Corey Hamm, pianos
Rajat Nigam and Trevor Brandenburg, percussion

INTERMISSION

Première Sonate (1921)
I. Allegro appassionato
II. Adagio
III. Allegro Molto

Béla Bartók
(1881-1945)

Dianne New, violin
Roger Admiral, piano

This recital is presented in partial fulfilment of the requirements for the Doctor of Music degree for Mr Admiral.

Roger Admiral and Corey Hamm are generously supported by The Beryl Barns Memorial Graduate Awards.

In Recital

Roger Admiral, piano
Candidate for Doctor of Music degree in Piano

Tuesday, April 19, 1994 at 8:00 pm

Suite Op. 14 (1916) — Béla Bartók (1881-1945)
Allegretto
Scherzo
Allegro molto
Sostenuto

Hosu (1986; revised 1989) — Howard Bashaw (b.1957)
The Mountain
The Lake
The Waterfall

Images, Deuxième Série (1908) — Claude Debussy (1862-1918)
Cloches à travers les feuilles
Et la lune descend sur le temple qui fut
Poissons d'or

Intermission

Sonata in B-Flat Major, Op. 106 (1817-1818) — Ludwig von Beethoven (1770-1827)
("Grosse Sonate für Hammer-Klavier")
Allegro
Scherzo-Assai vivace
Adagio sostenuto
Largo-Allegro risoluto
(Fuga a tre voci, con alcune licenze)

Roger Admiral is recipient of the Beryl Barns Memorial Graduate Awards.

This recital is co-sponsored by the Edmonton Composers Concert Society.

Convocation Hall, Arts Building

Department of Music
University of Alberta

Lecture-Recital
March 21, 1995
Room 1-29, Fine Arts Building

Roger Admiral, piano

"Sound Objects and Departing Landscapes," featuring examples from the music of:

Morton Feldman
Mario Davidovsky
Karlheinz Stockhausen
Denis Smalley
Pauline Oliveros
Alvin Lucier
Roger Admiral

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Timbre and Instrumental Specificity as Structural Elements in Modernist Musical Composition

Introduction

In the course of the twentieth century, modernist composers have come to recognize timbre and instrumental specificity as vital determinants for compositional methodologies. In the resulting work of many composers, qualities inherent in a musical instrument, such as timbre and sound production, emerge in the foreground of musical texture and are equal in importance to elements such as pitch, duration and dynamic level. In this essay I will examine different manifestations of timbre and instrumental specificity shown through composers' attitudes towards orchestration and through selected recent musical examples involving piano and percussion instruments. My objective is to consider both compositional approach and musical notation, and the different ways in which the two deal with timbre and instrumental specificity.

The essay is divided into two parts. The first part traces an historical and contextual background to the topic, in the course of which the evolution of orchestration, the growing trend towards highly differentiated timbral organization, and the development of electroacoustic music are discussed. The second part of this paper examines specific musical examples showing different types of instrumental specificity. Instrumental specificity is defined here as inherent, tangible and physical attributes of a musical instrument and its means of sound production as they are integrated into, and help to generate, the structure and discourse of a musical composition. The content and character of a work are thus contingent on its being played on a particular instrument or

collection of instruments. The musical examples for part two are taken from scores composed between 1960 and 1989. They represent several different artistic intentions, as follows:

1. The so-called 'spectral' school of composition, of which Tristan Murail's *Territoires de l'oubli* for solo piano is representative. The point of departure for this work is the piano's physical definition as a "group of strings whose vibration is caused by sympathetic resonance or by direct action of the hammers."[1] Selected examples show how Murail incorporates resonance of partials from the overtone-series into the composition. Here sound is treated as an evolving organism.

2. The use of amplification as a process in exploring the microlevel characteristics of an instrument's sound potential as exemplified in works of Karlheinz Stockhausen, Alvin Lucier, John Cage and David Tudor.

3. The unique aesthetic polemic of Helmut Lachenmann's *Allegro sostenuto*, scored for clarinet, cello and piano. Traditional and non-traditional methods of sound production permeate the work's surface texture. Delineation of the continuum of silence-to-noise-to-tone is part of the work's structural dialectic. The instruments' ontological status, their historically stereotypical use and the fetish of beautiful sound inform this dialectic.

In all the examples, whether they involve timbre or instrumental specificity, the focus is on the composer's relation to instruments. The instrument transcends its traditional functions as a producer of abstract pitches and an element within the larger

design of orchestration , while its characteristic features, be they sound production or harmonic spectra, serve as the germinating force of a work.

Part 1: Orchestration and Differentiated Timbre

> *One finds in Berlioz certain instrumental ideas that are an integral part of the composition rather than a surface veneer. I think there is an important difference between the two attitudes: instrumentation has become such an integral part of composition that the work acquires from the instrumentation not a kind of acoustical enrichment but a formal and functional one, then one can say that real progress has been made.*[2]
>
> Pierre Boulez, *Conversations with Boulez*

This first part of the essay is an historical presentation of a number of musical examples showing how timbre and choice of instrument were first associated with text or affect and later became tools for more abstract construction.

The early history of instrumental writing demonstrates a gradual shifting away from an initial dependence on vocal writing. Instruments often doubled vocal parts in Renaissance motets or madrigals and choice of instrument was left up to the performer, who took into account the occasion, the acoustics and the instruments available. The development of monody in the late 1500s necessitated the development of *basso continuo* to provide harmonic accompaniment. *Basso continuo* practice consists of two parts: a written-out bass line, to be played by one or more instruments, and written harmonic symbols, implying a realization of the bass line by any of a variety of keyboard or plucked polyphonic instruments or a combination of these, depending on what was

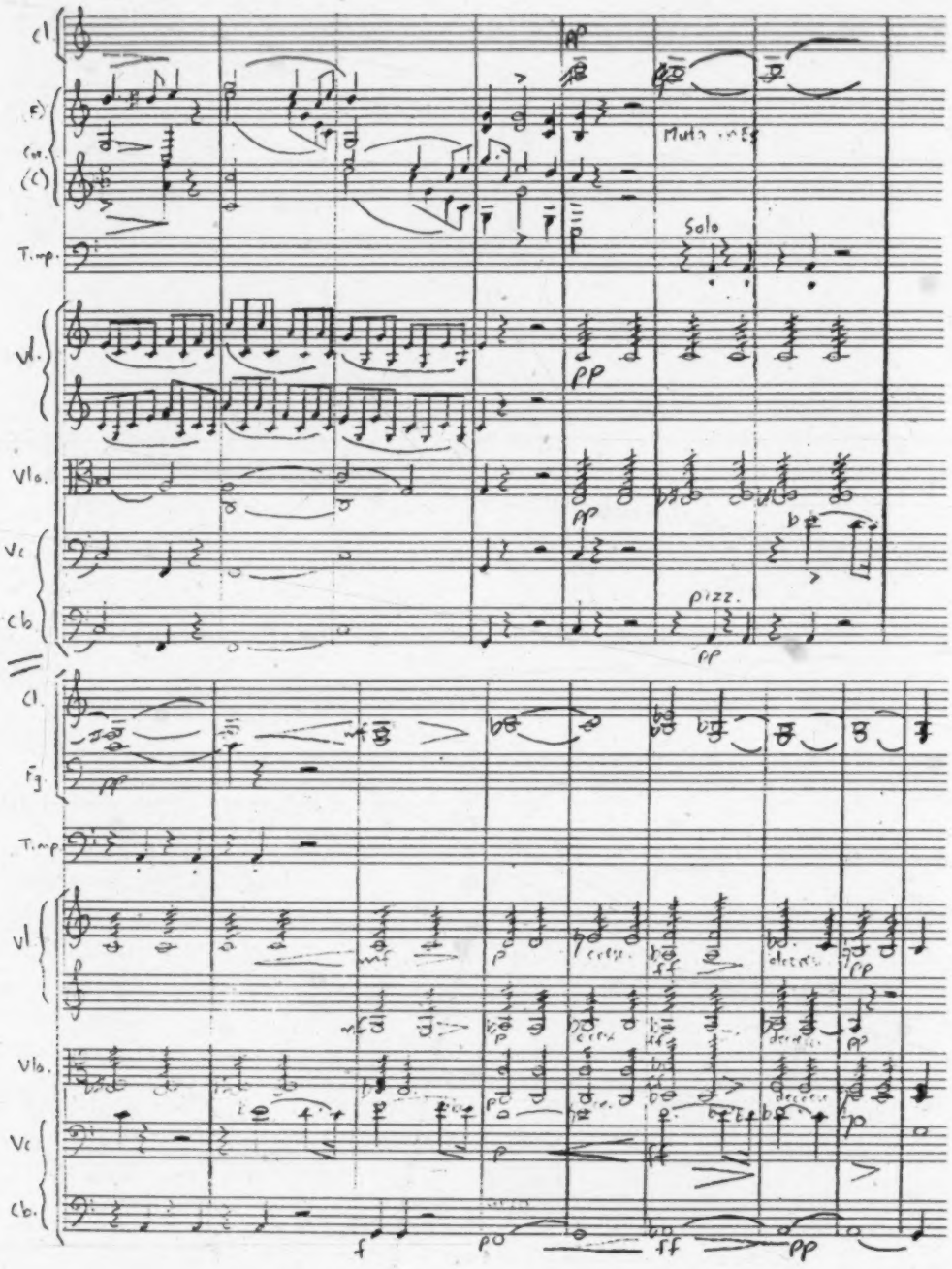
available. Sometimes specific instruments were named, as suggested by the text in an operatic context, and as can be seen in Claudio Monteverdi's opera *Orfeo* (1607).[3]

The score of *Orfeo* calls for a large variety of continuo instruments, enabling subtlety of expression in recitative sections. These instruments include harpsichords, archlutes, bass viols, arch citterns, a reed organ and an organo di legno. The organo di legno with its sombre quality is often identified with the underworld, and even in the world of the living the organo di legno is always heard when death approaches - in Act II when Messaggera delivers the grave news about Euridice, or when Orfeo sings "Tu sei morta" (measure 313).

The orchestra can be divided into two groups of instruments in this work, those of the world of the living and those of the underworld. Violins and recorders are prominent in the pastoral scenes of Act I (measures 75ff) and II (measures 25 - 122). Cornetts and trombones are featured in Act III when the narrative enters the underworld (measures 153ff or 404ff).

Orfeo also displays examples of instrumental intonation adding to the dramatic effect of the text. Tonalities with more than two sharps or flats can sound out of tune on instruments tuned according to the mean-tone tuning of the early baroque. When Euridice sings "*Ah, vision too sweet and too bitter*," after Orfeo turns back and is about to lose her forever, the harmony moves from g (two flats) to E-flat (three flats) to E (four sharps) (measures 235 - 237). The impure tuning that results from the harmonic movement of the instruments underlines the pathos at this moment in the opera. [4]

A much later example of instruments' functioning as symbols divided between opposing worlds appears in Carl Maria von Weber's *Der Freischütz* (1821). This opera's action takes place in the divergent worlds of light and dark. In a letter to J. C. Lobe, Weber states that the tone color of the opera "matches the two principal elements of hunting life and the rule of demonic powers; horns being the former and the latter represented by the lowest register of the violins, violas, basses, low register of clarinet, bassoon, horn, hollow rolls of drums or single hollow strokes."[5] Depiction of this atmosphere of opposition is most effective in the Overture (Example 1) and in the Wolf's Glen scene of the Finale to Act I.



Example 1 Carl Maria von Weber, *Der Freischütz*, Overture. mm. 21-36

"Symbolism and affectivity" of instrumentation is also prevalent in Berlioz's *Treatise on Instrumentation.*[6] The treatise functions as a technical guide on ranges, notation, versatility and typical use of instruments of the orchestra. Besides practical suggestions, Berlioz comments on the appropriateness of instrument and affect. For the latter, it is significant that, besides Beethoven's symphonies, most examples in the *Treatise* are taken from operas and tone poems. The oboe can express "artless grace, pure innocence, mellow joy and the pain of tender soul."[7] The flute is appropriate for adding "expression of desolation to a sad melody, combined with a feeling of humility and resignation"[8] and the horn is a "noble and melancholy instrument."[9] Richard Strauss expanded the treatise in 1904, incorporating examples from the music of Richard Wagner (showing new instruments, the expanded range of instruments and the range of possibility in combining them).

Wagner's opera *Lohengrin* (1848) requires a much-expanded orchestra in comparison with that of other operas and symphonic works of Berlioz's time.[10] This increase in number and type of instruments makes a greater variety of scoring possible. One way Wagner exploits this (a way which points also to Schoenberg's *klangfarbenmelodie*)[11] is by color change through variety of woodwind doubling (see the scene between Ortrud and Telramund measure 254ff of Act II at the text *"Du wilde Scherin,..."*, and the beginning of Scene 2 where Elsa appears on the terrace).[12] In his book, *In Search of Wagner*, Theodor Adorno points out another feature and possible interpretation of Wagner's woodwind scoring when he notes the homogeneity in a passage related to the character Elsa, in measure 9 of Act I, scene 2, where the registers of

the individual woodwinds and the woodwind combinations make an allusion to the idea of the wedding by simulating an organ sound.[13]

Claude Debussy's refined divided string writing reflects some of the innovations in Wagner's scores. (See, for example, the Prelude to *Lohengrin*, where the violins are divided into eight different groups with four of those groups beginning on harmonics.) The first movement of Debussy's *Nocturnes* (1899), entitled *Nuages*, is a good example of his use of divided strings. *Nocturnes* was orinally intended for violin solo with string orchestra. In a letter to Eugene Ysaÿe, the violinist and dedicatee of the work, Debussy writes that the first movement was an "experiment in finding the different combinations possible inside a single color, as a painter might make a study in gray."[14]

Figure 1 shows the string section of *Nuages*. The diagram is designed to show the variety of changing string divisions to which Debussy alludes in his letter. Durations within each string grouping are indicated by "-" (arco), by "." (pizzicato), by "-" (harmonics), and by "--" (tremolo).

Figure 1 Claude Debussy, *Nuages*, string divisions. mm. 7 - end

While "shades of gray" can be heard in Debussy, a greater variety of color is embodied in *klangfarbenmelodie* (tone-color-melody). Schoenberg defines this term in his *Harmonielehre* (1911) as "a melodic pattern produced exclusively by changes in the timbre duration and dynamics of a single pitch or chord."[15] An early example of this appears in his *Farben*, from *Five Pieces for Orchestra* Op. 16 (1909). Canonic procedures underscore this movement yet pitch change and rhythmic activity are kept in the background of the musical texture while alternating and changing instrumental colors appear in the foreground.

An example similar to *Farben* is in the third song of Alban Berg's *Altenberg Lieder* Op. 4. Woodwinds and brass play a twelve-note chord at the song's beginning. This chord is repeated four times, each time with the instruments changing pitch and, as a result, changing their distribution throughout the chord. Figure 2 displays the first five chords, listed by performing instruments, showing how they are distributed from top to bottom and how the chordal arrangement is different in each repetition.

1	2	3	4	5
E flat clarinet	flute	oboe	F trumpet	B flat clarinet
B flat clarinet	E flat clarinet	F trumpet	oboe	flute
flute	oboe	E flat clarinet	B flat clarinet	F trumpet
oboe	F trumpet	flute	E flat clarinet	English horn
F trumpet	bassoon	B flat clarinet	flute	F horn
English horn	B flat clarinet	bassoon	B flat bass clarinet	B flat clarinet
B flat bass clarinet	English horn	trombone	F horn	oboe
F horn	trombone	English horn	bass trombone	B flat bass clarinet
bassoon	bass trombone	B flat bass clarinet	English horn	trombone
trombone	contrabassoon	contrabassoon	bassoon	bass trombone
bass trombone	B flat bass clarinet	F horn	contra bassoon	contra basssoon
contra bassoon	F horn	bass trombone	trombone	bassoon

Figure 2 Alban Berg, Altenberg Lieder Op. 4, *Über die Grenzen des All*

Highly differentiated timbral differences, evident in *klangfarbenmelodie*, stand more in relief when the instrumental texture is relatively sparse. This feature is very evident in Webern's music where, in the course of a typical work, few instruments might be heard simultaneously yet instrumental color may change constantly. His music demonstrates a strong concern for timbre because its contrapuntal texture divides into many smaller timbral particles, showing that continuum is not contingent upon consistency of the use of one instrument for an entire line. Webern's experiments with different chamber music combinations also reflect his interest in timbral color possibilities. This is evident especially in the songs written between 1910 and 1925. Figure 3 lists the instruments accompanying the vocal part for each opus.

Op. 8 (1910): clarinet, bass clarinet, horn, trumpet, celeste, harp, violin, viola, violoncello

Op. 14 (1917-19): clarinet, E flat clarinet, bass clarinet, violin, violoncello

Op. 15 (1917-22): flute, clarinet, bass clarinet, trumpet, harp, violin, viola

Op. 16 (1923-24): clarinet, bass clarinet

Op. 17 (1924-25): clarinet, bass clarinet, violin, viola

Op. 18 (1925): E flat clarinet, guitar

Figure 3

The creation of a new instrumental grouping for each new work (exemplified in Figure 3 above) became a more common occurrence from the early 1900s onwards. According to Carl Dahlhaus, this helped bring about the end of genre. In the symphony, the string quartet and the short piano piece there had been a connection between overall

musical form and scoring,but "In Webern's music there is no typical connection between form and scoring which corresponds to a genre norm, but a special, individual nexus rooted in the unrepeatable character of the single piece....Klangfarben technique presupposes a variability of instrumental resources which runs counter to the establishment of certain patterns of scoring as genre-determining types."[16] Schoenberg's *Chamber Symphony* Op. 9, *Pierrot Lunaire* and *Suite* Op. 29, Debussy's *Sonata for flute, viola and harp*, Stravinsky's *Three Japanese Songs*, and Ravel's *Chansons Madecasses* are also examples of this trend.

Pierre Boulez's *Le Marteau sans Maître* (1955) is a rather later example of this direction and shows furthermore how it can relate to instrumental specificity. Boulez's scoring relates specifically to the inherent characteristics of sound production and the potential of unique relationships among instruments. All the instruments in Boulez's score are of a medium pitch register, providing an effective accompaniment to the contralto voice because of their shared tessitura and color. He explains this combination of instruments and its interrelationship of elements in an article entitled "Dire, jouer, chanter" (which also deals with Schoenberg's *Pierrot Lunaire*).[17] The voice and alto flute, he says, connect through the use of the performer's breath; viola and alto flute share the ability to maintain a sustained monodic sound; pizzicato viola and guitar are both plucked stringed instruments and are thus related despite the guitar's longer resonance. Similarly, the guitar and vibraphone are both long-resonating instruments while the vibraphone, when the bars are damped, is related to the struck wood bars of the xylophone, both instruments having a short dry resonance.

On a structural level, Boulez's *Eclat* is another work where the chosen ensemble relates directly to the resulting musical texture. The structure of alternating strictly metered and rhythmically flexible sections is a reflection of the ensemble's two contrasting layers: sustaining instruments and those with short resonance.[18]

Instrumentation and structural organization integrate also in Edgard Varèse's *Ionisation* (1938), written primarily for unpitched percussion. The material construction of each instrument is one way Varèse organizes the work; he juxtaposes instrumental choirs of metal, membrane or wood instruments. On a more detailed level, there is a relationship between the decay of each instrument's resonance and its usual rhythmic articulation: e.g. an instrument with a short decay in resonance would have rapid articulations while instruments with longer decays might have notes of a longer duration. Some examples are shown in Figure 4.

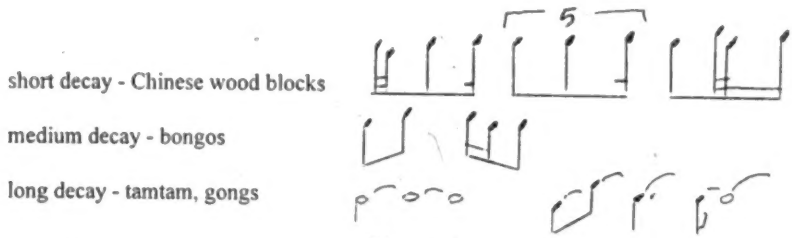


Figure 4

Percussionist Jean-Charles François explores this in detail in an article in *Perspectives of New Music*.[19]

Instruments can be integrated with structure and timbre, and further differentiated through specific spatial association and distribution. In the twentieth century composers have experimented with spatial placement of instruments within an ensemble setting.

They rearranged the traditional nineteenth-century orchestral set-up (strings in front, woodwinds behind and brass and percussion in the back) in a variety of ways. Rearrangement and spatial isolation of instruments coincided with the experiments in instrumental groupings and with the creation of a type of antiphony of instrumental choirs, each with its own timbral profile. Figures 5a, b, c, and d show how different works have been arranged timbrally. In each case the arrangement has been specified by the composer.

Double Bass I		**Double Bass II**	
Violoncello I	**Timpani**	**Bass Drum**	**Violoncello II**
Viola I	**Side Drums**	**Cymbals**	**Viola II**
Violin II	**Céleste**	**Xylophone**	**Violin IV**
Violin I	**Pianoforte**	**Harp**	**Violin III**

Figure 5a Béla Bartók *Music for strings, percussion and céleste* (1937)

The spatial arrangement of the strings shown in Figure 5a allows for antiphony. Of special note is the prominent role of the percussion section, which is emphasized by the fact that it is placed in the middle and reaches to the front of the stage, rather than being behind the strings.

Percussion 2 **Percussion 3**

Trombone **Bassoon**

Percussion1 Horn I Trumpet Flute Oboe Clarinet Horn II Percussion 4

Double Bass _____ Viola _____ Violin _____ Violoncello

Harpsichord **Piano**

Figure 5b Elliot Carter *Double Concerto for piano and harpsichord (1961)*

Carter's *Double Concerto* is also an antiphonal piece. The two soloists and their respective, small orchestras form distinct sonorous entities: the harpsichord orchestra is meant to have a 'baroque' sonority and includes many dry percussion instruments; the piano's orchestra is intended to be more "expressive and 'classical' "[20] and includes more membramophones in the percussion parts, providing dynamic volatility. The many percussion instruments are spaced evenly around the back of the ensemble in order to differentiate antiphonal and circular movements written into the music.

bells

percussion 2

percussion 1 **pianoforte**

percussion 3

percussion 4

vibraphone

harp

céleste

soprano

Figure 5c Pierre Boulez, *Deuxième Improvisation sur Mallarmé* (1961)

The instruments for Boulez's *Deuxième Improvisation sur Mallarmé* are arranged so that the pitched, partially pitched and unpitched instruments blend with each other. According to the composer, balance is the determining factor here.[21]

vibraphone, tambourine, triangle
marimba
piano, 9 chinese gongs
11 tubular bells, 2 bongos
6 basses, electric guitar
céleste, 2 harps

xylophone, timpani
5 cowbells, triangle
4 violoncellos, bass clarinet
2 baritone saxophones
2 clarinets, 4 flutes

4 horns, 2 tenor saxophones
3 trumpets, tuba
2 trombones
2 snare-drums, 10 violas

audience

4 horns, 3 trombones
bass tuba, 10 violins
3 tam-tams, 3 suspended cymbals

2 oboes, English horn, piccolo clarinet, 2 bassoons, contrabassoon, 4 violoncellos
3 trumpets, 2 tenor-drum, 3 tom-toms, 4 temple-blocks, glockenspiel

Figure 5d Luciano Berio *Allelujah II (1956)*

Berio's *Allelujah II* is a work similar to Stockhausen's *Gruppen* (1957) and *Carré* (1959) where small orchestras of distinct timbral identity surround the audience. Each group of instruments has its own distinct blend of strings, woodwinds, brass and percussion. The specific spatial arrangement allows for a textural counterpoint to be heard more clearly because of the separation between each group.[22]

The poetics of material, *klangfarbenmelodie* and spatial diffusion are refined further in electroacoustic music, now often referred to as acousmatic music. The French composer, François Bayle, who currently directs the studios of the Groupe de Recherches de Musique (GRM) in Paris, defines acousmatic music as a "pure listening situation, where attention cannot be drawn or reinforced by a visible (or predictable) instrumental causality."[23] The acousmatic composer and listener divorce the sound from its visual source. The term acousmatic refers to Pythagoras's students listening to his teachings

from behind a curtain so that there was no visual medium to distract them from hearing his words.

Acousmatic music exemplifies timbre as integrated in structure because recorded sounds (*objêts-sonore*) serve as the base material for it. This is what differentiates it from other electronic music where sounds are created synthetically using synthesizers and computers. In acousmatic music, sound has a fixed identity once it is on tape and, as a physical object (the amplified audio signal), it can be manipulated spatially with great flexibility. Compositions within this medium are played over loudspeakers (which can number from 2 to 100 or more) and the sounds, organized over multiple recorded tracks and controlled with a mixing board, are diffused over a spatial continuum (left, right, back and front).

These examples, presented in chronological order, show a gradual shift in modernist composers' attitudes towards timbre and instrumental specificity. Associating instruments with affects or symbolism in support of a text is gradually replaced by a more abstract experimentation with instrumental combination, tone color and timbral organization.

Part 2: Instruments With Attack And Decay Envelopes

"...it seems to me that its inherent nature becomes really expressive only by means of the present tendency to use the piano as a percussion instrument."

Béla Bartók, *Essays*

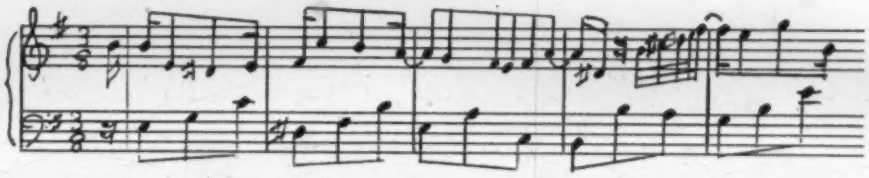
"Percussion writing is a music of contingency."

John Cage, *Percussive Notes*

The piano and percussion instruments are ideal for integrating instrumental specificity with structure because of the instruments' natural decay in resonance. After the initial attack, a percussion instrument's resonance continues without human intervention. The resulting decay in sound and its evolution can be analyzed and the results incorporated into a composition) or reacted to in a real-time performance situation. The widespread use of percussion and the consideration of the piano as a percussion instrument are incontestably twentieth-century phenomena. The early history of the piano might be said to focus on other qualities of its sound.

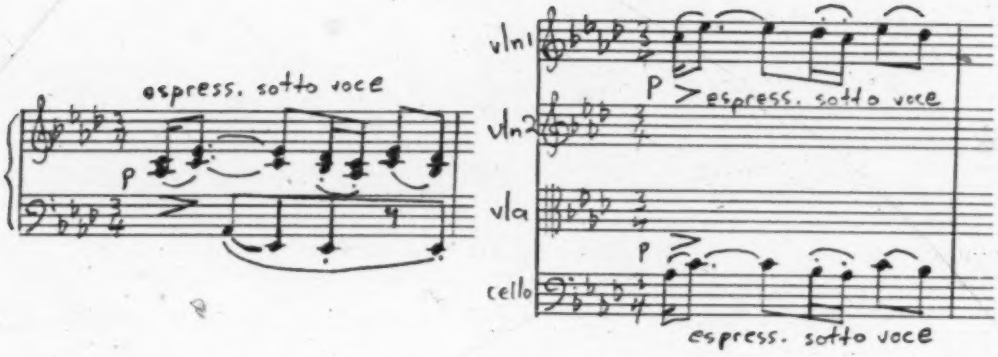
Much of the recent literature on authentic performance practice of baroque and classical keyboard music refers to keyboard or string instrument treatises and music of the time in question. Looking at the score of a work of Johann Sebastian Bach, one sees a page that is often bereft of detailed performance instructions such as dynamic, articulation or tempo. The tempo of a work from this time period is often arrived at by consideration of the time signature or by the movement's similarity to one of the many stylized dance forms of the time, or both. In matters of articulation, however, one might often compare the keyboard figurations with those of string instruments. String music

flourished in the baroque because of advances in instrument making (for example, in the work of violin makers from Cremona and Brescia) and innovations in string writing by the masters Geminiani, Corelli and Vivaldi, etc. Music that was idiomatic for string instruments usually included articulation markings related to bowing techniques. Keyboard players, whose purpose was, primarily, the harmonic realization of figured bass, could look at string figurations for matters of articulation in written keyboard compositions. In this case the string music is instrument-specific for strings, and keyboard writing style evolves out of it. For example, a walking-bass figuration (Example 2) could be played detached imitating the detaché (or louré) style of the cello or viola da gamba.[24]



Example 2 Johann Sebastian Bach, Partita in E minor (1731), *Corrente,* mm. 1-5

Piano writing and articulation is tied into string writing in much nineteenth century chamber music as well. In the typical sonata form of a piano quintet, involving development of themes and motives, the piano and strings share the same music material. In example 3 we see two two-bar fragments marked *espressivo sotto voce.* The articulations are the same for piano and for violin and cello.



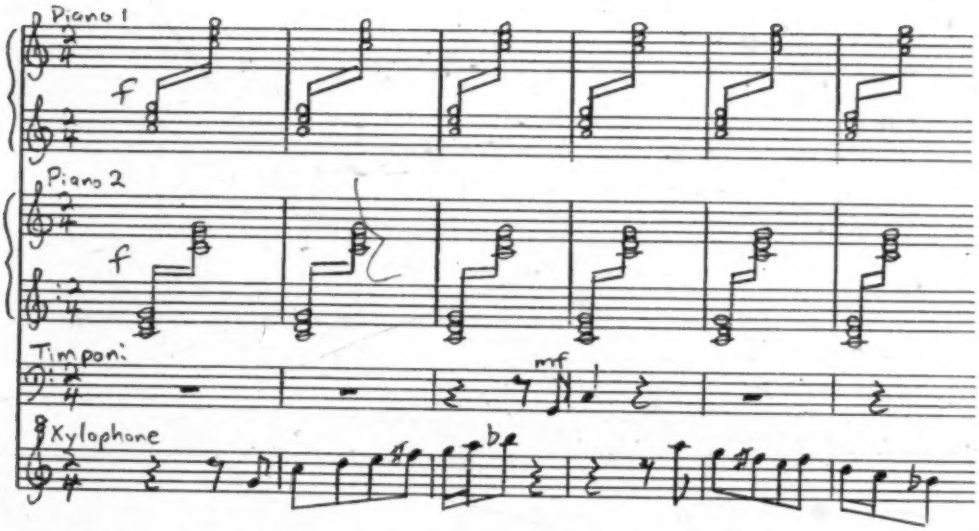
Example 3 Johannes Brahms, Piano Quintet in F minor (1864), 2nd movement, mm. 75 and 83

The piano, being a polyphonic instrument, is capable of matching equally with the sound capabilities of a string quartet, in terms of its volume and ability to play many notes simultaneously. Stringed instruments, however, are very different from the piano because of their sound production through bowing. They can produce a legato sound where the piano cannot. This creates for the pianist the challenge of trying to imitate the legato and bowing strategies of a stringed instrument (or of a singer in Lieder performance). In stark contrast with accepted practice, however, Béla Bartók accepts this difference and exploits it in his sonatas for violin and piano by giving the two instruments contrasting material.

Bartók shows his attitude towards the piano and specificity with his statement in answer to a questionnaire quoted earlier.[25] The low clusters that imitate drum sounds in *With Drums and Pipes* from *Out of Doors*, instantiate the statement. However the

percussive aspect (specifically its envelope of attack and decay) is only one inherent characteristic of the piano. Another is its potential for sympathetic vibrations and reinforcement of pitch through the overtone series. This is made possible because the strings are housed in a resonating body and, by raising the dampers, all strings are allowed to resonate. The examples that comprise the next chapter of this essay deal with resonating bodies that share the same type of percussion morphology of a performer's attack followed by the natural decay and instability of the instrument.

Ernö Lendvai's extensive, landmark analysis of Bartók's *Sonata for 2 pianos and Percussion* (1937) shows how the acoustical phenomenon of the overtone series can be used to emphasize differences in the character of the music. He refers to the difference in harmonic language used in the sonata's first and third movements. The sonata's first movement theme is highly chromatic and revolves around intervals of a minor third, a perfect fourth and a minor sixth (as he notes, Fibonacci cells of 3, 5, 8 intervals). At the beginning of the 3rd movement the pianos both play unadorned C major triads while the xylophone theme (Example 3) contains pitches and intervals not prevalent in the first movement but featured in the overtone series of fundamental C natural:



Example 4 Béla Bartók, Sonata for Two Pianos and Percussion, 3rd movement, mm. 4-10

Lendvai's refers to this as the "acoustic" scale. Over a sketch of the finale-theme Bartók writes "fresh and cheerful".[26] The lightheartedness of the third movement contrasts greatly with the dramatic tension of the first movement and this is partly attributable to contrasting intervals that Bartók chooses as his material. Example 4 shows how instrumental sound, as a physical phenomenon, can dictate the melodic and harmonic materials of a work.

Using the acoustic phenomenon of the overtone series as part of a compositional structure is more prevalent in *Territoires de l'oubli*, a work for solo piano composed by Tristan Murail (b. 1947). In the company of composers such as Gerard Grisey, Michael Levinas and Hugue Dufourt, Murail is a member of a French composers' and performers' collective called L'Itineraire. These composers belong to the generation born in the 1940s and, as a group, their activities begin in the early 1970s. The music of Murail and Grisey

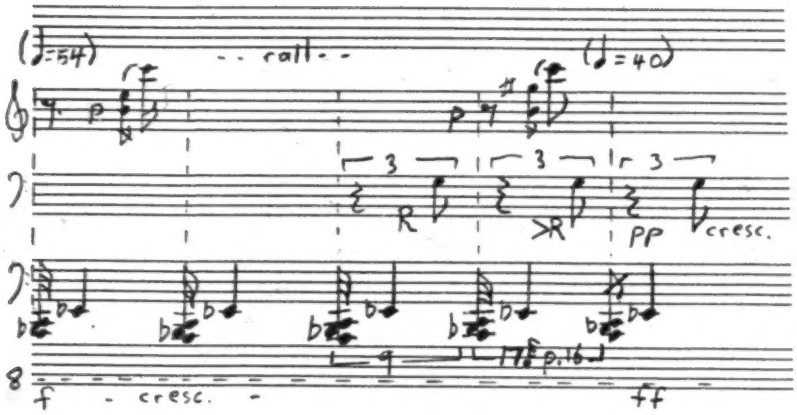
is referred to often as the "spectral" school of composition. In their work, acoustical characteristics of timbre are the raw materials for small and large level musical structures. The development of this style of composition was facilitated by computer research into psychoacoustics, timbre and instruments. Researchers such as Jean Claude Risset and John Chowning measured timbre using digital technology and displayed the results graphically, showing the complex groups of harmonic partials that make up timbre and revealing its instability. "This study of sounds gives us the ability to better act on the sounds, to perfect instrumental techniques and comprehend sonic phenomenon. It permits us also to develop a musical writing based on the analysis of sounds and to make the internal forces of sounds one of the points of departure in the work of the composer. The properties of spectra furnish us with harmonic ideas and permit us also to create agglomerates that are neither harmony nor timbre. They are progressions in the domain of timbre-harmony."[27]

Much of this renewed attention to sound is a reaction against composition with twelve tempered tones where the notation is based on classification by sound symbol of a physical phenomena. This notation cannot take into account phenomena such as noise, complex sonority, or microfluctuations in pitch. "Tonal and serial structures failed in the organizing of intermediate categories (of sound) because they project inflexible grids on a sonorous reality."[28] But as timbre is variable, whatever its duration, it is more realistic, "more conforming to physical reality and perception to consider sound as a field of energies, each having its own evolution,"[29] rather than basing a musical structure on sound symbols. In the resulting compositions, forms stem from the "evolution of

sounds," blurring the distinction between material and form. "They are aspects of the same phenomenon."[30] This talk of unifying material and form is similar to remarks Stockhausen makes about timbre (see below).

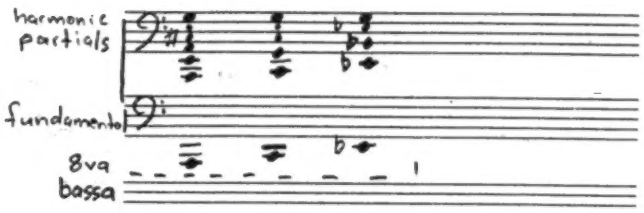
Territoires de l'oubli

Murail's *Territoires de l'oubli* (1977)[31] provides examples of the objectives described above. Throughout the 25-minute duration of this work the piano's damper pedal is held down, leaving all strings free to vibrate sympathetically with strings that are struck. The initial causality of percussive attack initiates an indirect causality through sympathetic vibration of partials. The overall shape of the work's discourse is that of slowly evolving complex chordal figurations combined with repetition, the latter functioning to emphasize partials.[32] The notes within these chordal agglomerations are related to partials of other fundamentals present in the musical texture.[33] For example, at several points in the work new harmonies are arrived at through suggestion via resulting harmonic partials. This is done by repeated *ff* clusters in the lower register with common partials from the fundamentals within the cluster forming the basis of the new harmony. This will be detailed below.



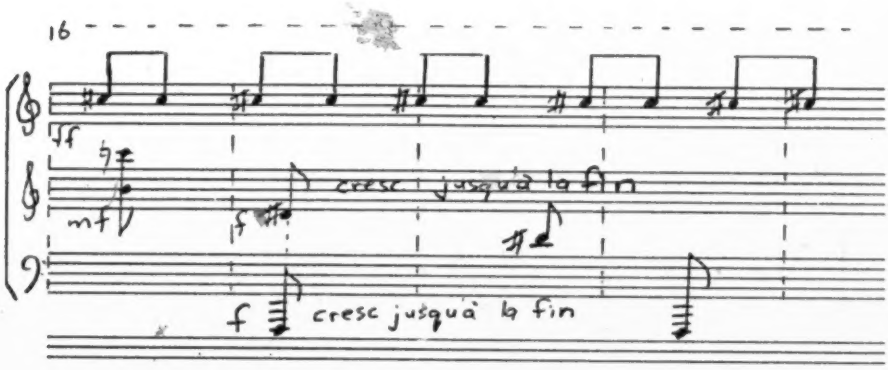
Example 5 Tristan Murail, *Territoires de l'oubli*, page 5, first system

Example 5 shows a passage from page 5 of the published score. We see a cluster containing the pitches A_1, B-flat$_2$, C-natural$_4$ and E-flat$_7$ in the lowest register of the piano.[34] This cluster is repeated *ff* a number of times. Murail indicates G-natural$_{47}$ to be played. When it first appears he indicates it with the letter "*R*", indicating that the attack should be almost inaudible as if coming out of the resonance of the instrument. Gradually G- natural$_{47}$ is to be played with greater intensity. If one examines the partials of the pitches in the repeated low cluster one sees that G-natural$_{47}$ is common to three of the four fundamentals that are notated (Example 6). Therefore it would be audible already as part of the timbre of the cluster and then played directly later as part of the harmony. In this way the contradistinction between timbre and harmony is blurred.[35]



Example 6 Fundamentals and partials of example 5

The naturally occurring partials of the sympathetic vibrations have a different effect near the end of the work. The pitches F-natural$_9$, D-sharp$_{43}$ and C-sharp$_{77}$, as shown below (Example 7), are repeated from page 34 until the end of the work .

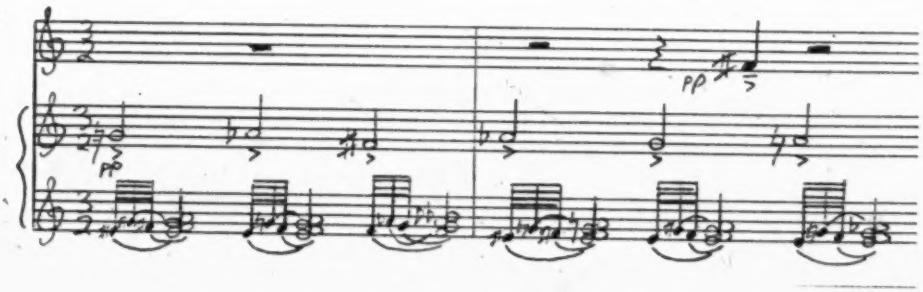


Example 7 Murail, Op. cit., page 34, first system

The F-natural$_9$ and the D-sharp$_{43}$ are fundamentals in this context. The seventh partial for F-natural$_9$ is around E-flat$_{43}$ (enharmonic spelling of notated D-sharp$_{43}$) and the seventh partial of D-sharp$_{43}$ is around the notated C-sharp$_{77}$. Measurement in Hz shows that the seventh partial of F-natural$_9$ is appreciably lower than D-sharp$_{43}$ of an equal tempered

piano, thereby creating a type of vibrato sound because of beats arising from the difference between the naturally occurring partial and the struck D-sharp$_{43}$. The same is true of the relationship between D-sharp$_{43}$ and C-sharp$_{77}$ above it. In this way Murail uses a characteristic of an equal-tempered instrument to contribute to the musical material and thus moves decisively toward an integration of timbre and structure.

In much the same way, beats created by tuning interference also grow out of the cluster in Bartók's *The Night's Music* from *Out of Doors* (1926)[36] where the middle register drone (Example 8) of the piano seems to have a life of its own (beyond the initial attack) similar to the way a bagpipe drone goes on without human intervention. This aspect of Eastern European bagpipes causes the people of that area to view the instruments as living organisms and to associate them with the mysteries of nature.[37] This idea of the instrument playing by itself resonates with John Cage's remarks below.



Example 8 Béla Bartók, *The Night's Music,* mm. 1-2

Variations II

John Cage (1912-1992) uses piano and percussion instruments because of their natural decay in sound. This characteristic allows the performer freedom from intention

in terms of controlling an instrument's sound or the duration of that sound as the percussion instrument's sound decays of its own accord.

"I remain a percussion composer whether I write for percussion instruments or not. That is, my work is never based, structurally or as an instance of process on frequency but rather on duration considerations. For improvisation using percussion instruments there is a discontinuity between cause and effect. Variations in gongs, tom toms, etc. and particularly, variation in the effects on pianos of the use of preparations, prepared me for the renunciation of intention and the use of chance operations."[38]

Because of the variability and instability of their sounds, percussion instruments are ideal for realizing Cage's intentions of "renouncing intentions."[39] David Tudor's realization of Cage's *Variations II* provides an example of this aesthetic. Tudor was a long-time devoted performer of Cage's music and, in 1967, made a recording of his realization of *Variations II*.[40] The configuration that Tudor propounds in realizing Cage's instructions is a clear example of the instrument's influencing the structural flow of the work.

Cage indicates that the work is indeterminate and intended for any number of players using any sound-producing means. He includes eleven transparent sheets. Six have straight lines; five have points. The sheets are to be superimposed and perpendiculars are to be drawn from each line to a point. These drawn lines are measured and used by the performer to determine frequency, amplitude, timbre, duration, point of occurrence and structure of event. Tudor, who had begun to explore the possibilities of contact microphones and phonograph cartridges through performances of Cage's

Cartridge Music in the early 1960s, chose to use an amplified piano in his realization. In this realization a contact microphone and phono cartridge amplify the events occurring inside a piano by their attachment to material such as plastics, toothpicks, and pipe cleaners which come in contact with the strings of the piano. The visual realization of the score dictates the actions of the performer, but as part of the structure of each event, Tudor lets the resulting sound of one event dictate the nature of another event.

Cage and Tudor recognized that timbre cannot be measured or notated fully. In the score Cage notes, "If questions arise regarding other matters or details...put the question in such a way that it can be answered by measurement."[41] In his realization of *Variations II* Tudor's solution was to measure timbre as either simple or complex; the frequency could be simple or the overtone structure could be complex or the amplitude could have a complex fluctuation. An example of how Tudor might interpret these types of measurements can be seen in his notes on Cage's *For Paul Taylor and Anita Dencks*. He notes that certain sounds will be very short, with many overtones, longish, very high, *ff* etc.[42] It is a simple way of equalizing different musical parameters by using the same measurement system for each parameter (though 1 inch equals "3 seconds" and 1 inch equals "simple frequency" are not equal in their exactitude).

The total configuration of attack materials, piano and amplified sound in Tudor's realization can be regarded as the instrument because any sound generated in the system (such as sounds with few harmonics, sounds with rapid aperiodic amplitude, or sounds of audio feedback) would be accepted and utilized in the interaction of parameters dictated by the original transparent sheets. This process of one performer reacting to the real time

evolution of sound is possible because the instrument used has a natural decay in sound after an initial attack.[43]

Mikrophonie I

Interreactive performance elements, as a result of the revelatory process inherent in amplification, form the basis of Karlheinz Stockhausen's (b. 1928) *Mikrophonie I (1965)* as well. Amplification functions as part of a three-step process to discover the microlevel characteristics of the sound of an instrument, in this case a tam tam with diameter of six feet. Stockhausen's objective is the unity of material (instrument and timbre) and form within one work. That is his objective in other works as well: "the choice of instrument is part of the definition. The material itself must be part of the creative act. Which means that when I start a new piece the selection of either a pre-formed sound source and instrument or sound material must be already organized or structured the way the whole piece will be structured."[44] *Kontakte* uses "a range of timbres totally defined in their microstructures and accelerated into their pitch domain. This leads to rhythm arising from a specific complex division of a more fundamental duration, just as timbre arises from the complex subdivisions of a fundamental pitch. This way an entire composition could be conceived as "timbre" and music thereby relinquishes its narrative character."[45] Robert Maconie comments further on this:"...the use of clusters (in Stockhausen's *Klavierstück X*) creates an effect of shifting surfaces and may arouse in the hearer a renewed sense of the instrument as a totality of sound progressively mapped in patches and lines. Such a way of hearing leads directly to

Mikrophonie I where an entire range continuum of timbres is derived from a single instrument."[46]

Stockhausen also writes in *Die Reihe* about twelve-tone composition saying that harmonic and melodic relations between notated pitches have nothing in common with the micro-acoustical relation in the interior of instrumental sounds.[47] This realization, similar to that of Murail and the spectralists, led to his experiments with electronic music.[48] In *Mikrophonie I*, Stockhausen eschews equal-tempered twelve-tone composition altogether by using the timbral continuum of a large unpitched tam-tam.

Mikrophonie I is a demonstration of sound material dictating structure. This is due to the work's performance strategy. The work is scored for large tam-tam and six players. Two performers excite the tam-tam with a variety of materials (cardboard tubes, large soft mallet, sticks, metal or plastic rods). Indications on how the first two performers are to activate the sounds are given as descriptions of the desired sound (trumpeting, whirring, grating). The sounds are prescribed according to how they will be perceived aurally.[49] Two other performers scan the tam-tam with hand-held microphones. The score notates the distance between microphone and tam-tam, the relative distance of the microphone from the point of excitation and the rhythm of the microphone movements. A third pair of performers operate variable bandwidth filters which in turn influence the timbre and pitch of the amplified sounds and control the spatial element by sending the signals to four loudspeakers at each corner of the performance space.[50] Each sound and gesture in the work is audibly related to those that follow, and all contribute to a resonant image of the tam tam. In an article in *Perspectives of New Music*, Robin

Maconie writes "the work is constructed solely of derived qualities. It is not only theoretically integrated in form, but aurally integrated in sound."[51]

I am sitting in a room

Amplification as a revelatory process underlies Alvin Lucier's (b. 1931) *I am sitting in a room* (1969). The concept of sound being something to be discovered is behind many of Lucier's compositions and here amplification is the means towards that end. In this score the instrument is a room. A sound event (spoken word, a passage on a musical instrument or any other object of choice) occurs in a room and is recorded by a microphone set up in that room. The recorded sound is played back into the room and recorded onto another tape recorder. This second recording is played back into the same room and recorded by the first tape recorder. This process is repeated until the original sound is unrecognizable. The sound becomes unrecognizable because some of its waveforms are reflected out of phase and are gradually filtered out while other waves, having a simple relation in proportion to the dimensions of the room, are amplified because the reflections from the walls would increase the amplitude of the wave.[52] Lucier writes, "thinking of sounds as measurable wavelengths, instead of as high or low musical notes, has changed my whole idea of music from a metaphor to a fact and, in a real way, has connected to architecture."[53]

Through an additive and destructive process the resonant wave form of the room is revealed. The work is instrumentally specific because its objective is to identify characteristics of the room involved. In the written description of the score Lucier writes,

"choose a room the musical qualities of which you would like to evoke".[54] *I am sitting in a room* treats the room as a hollow resonant percussion instrument and uses amplification as a compositional process. In this case the initial instrumental causality or "attack" is the projection of sound into a room. The specificity of the room's resonant waveforms are discovered through the process of amplification.

Allegro Sostenuto

Helmut Lachenmann (b. 1935) also uses amplification for some of his works, but with a different purpose from that of Cage, Stockhausen or Lucier. In his case it is amplification as a revelatory process exposing and revealing traditional and non-traditional methods of sound production.[55] He is interested in uncommon instrumental sounds as sounds, but also in making a statement through their unusualness. Lachenmann's *Allegro Sostenuto* (1989)[56] does not require amplification but employs unusual instrumental sounds to achieve structurally his ideas on beauty, aura and the rejection of the norm.

Lachenmann has written lofty manifestos detailing concepts that are reflected in his compositional method. We are told that composition must consist of confrontation and provocation. The composer must confront and come to terms with the "*aesthetic apparatus*" that exists and has existed before him or her, including the sum total of categories of musical perception as they have evolved through history to the present day: notation, techniques of playing, and the social definition and fetish of beauty. This apparatus also includes buying concert tickets, dressing formally for a concert, reading

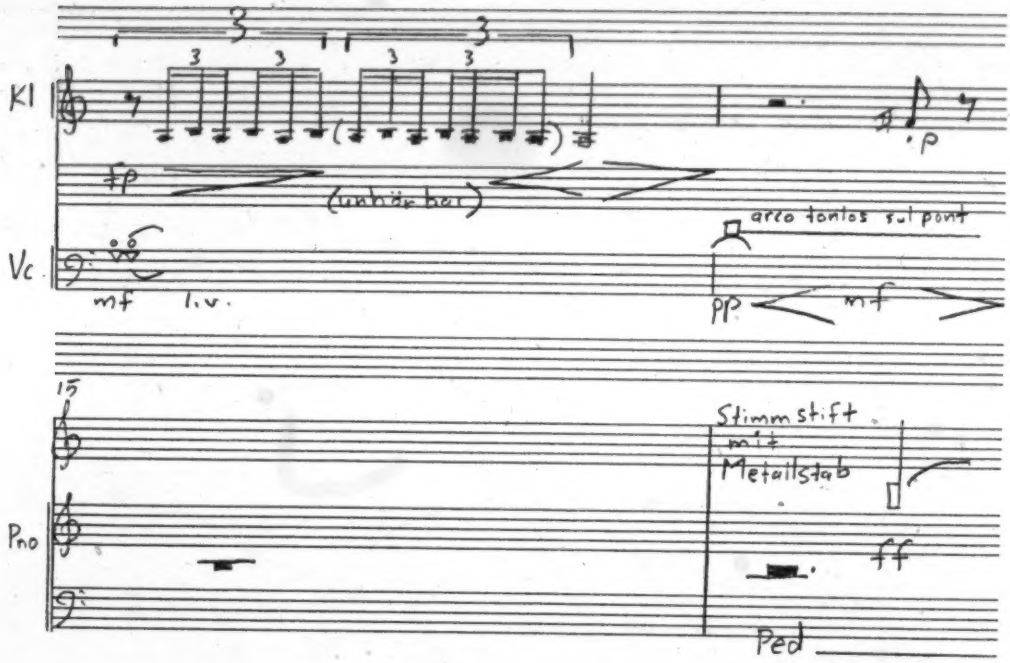
program notes, observing the deportment of the performers, applause, awareness of performance traditions through other concerts and recordings, tuning on stage, tuning strings at intervals of a perfect fourth, etc. Lachenmann chooses to reject the "*aesthetic apparatus*" and to create music out of the conflict that arises from the act of using traditional instruments while rejecting traditional habits.[57] "The concept of the Beautiful has to pass through this purging of itself via the real contradictions of social expectations....The mission of art lies neither in fleeing from, nor in flirting with, the contradictions which mold the consciousness of our society, but in coming to grips with them and dialectically mastering them....It is no longer possible for there to be responsible art without such conflict situations....Expressing oneself means entering into a relationship with one's surroundings; it means confronting questions posed by society and the existing categories of communication."[58]

Lachenmann refers to the aesthetic norms as the 'aura' as well. In his interpretation, the aura is the "realm of association, memories, archetypal predeterminations."[59]

Allegro Sostenuto is scored for clarinet (and bass clarinet) cello and piano.[60] The scoring has historical precedent in trios by Beethoven, Brahms and Weber. In this work the sonorities of those nineteenth century examples are avoided almost throughout. The work's discourse centers around delineating the continuum of silence-to-noise-to-pitch-to- sustained (sostenuto) sound. Sostenuto sound is present through long tones, tremolos, glissandi or arpeggios. Instrumental noises encompass the unusual playing techniques and also serve to expose the means of sound production (thereby rejecting the norm of

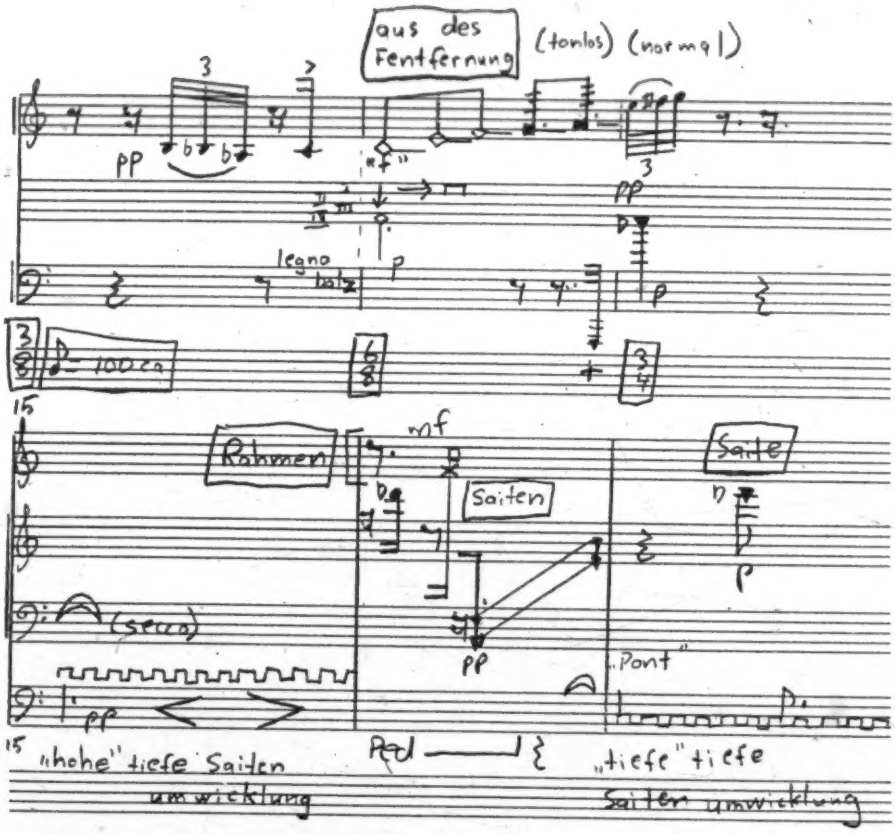
beautiful sound). Noises can be pitched or unpitched. Some examples are clarinet key-clicks and toneless blowing; cello *col legno* or bowing different areas of the cello body; dragging a metal beater across the piano's tuning pegs or scraping the strings with a guitar pick.

Many noises specific to the material of each instrument actually serve to blend with each other. The piano is defined in this work as a large resonating body which is set into vibration by numerous means, aside from the traditional manner of using the keyboard connected to its hammers. Percussive strokes, *fff* in the extreme high register with the dampers raised, create a type of white noise with the actual pitch decaying quickly in time. A similar sound is created when the tuning pegs are struck by a metal triangle beater. (See Example 9) This is complemented by the *tonlos* blowing of the clarinet and bowing on the bridge of the cello.



Example 9 Helmut Lachenmann, *Allegro Sostenuto,* mm. 100-101

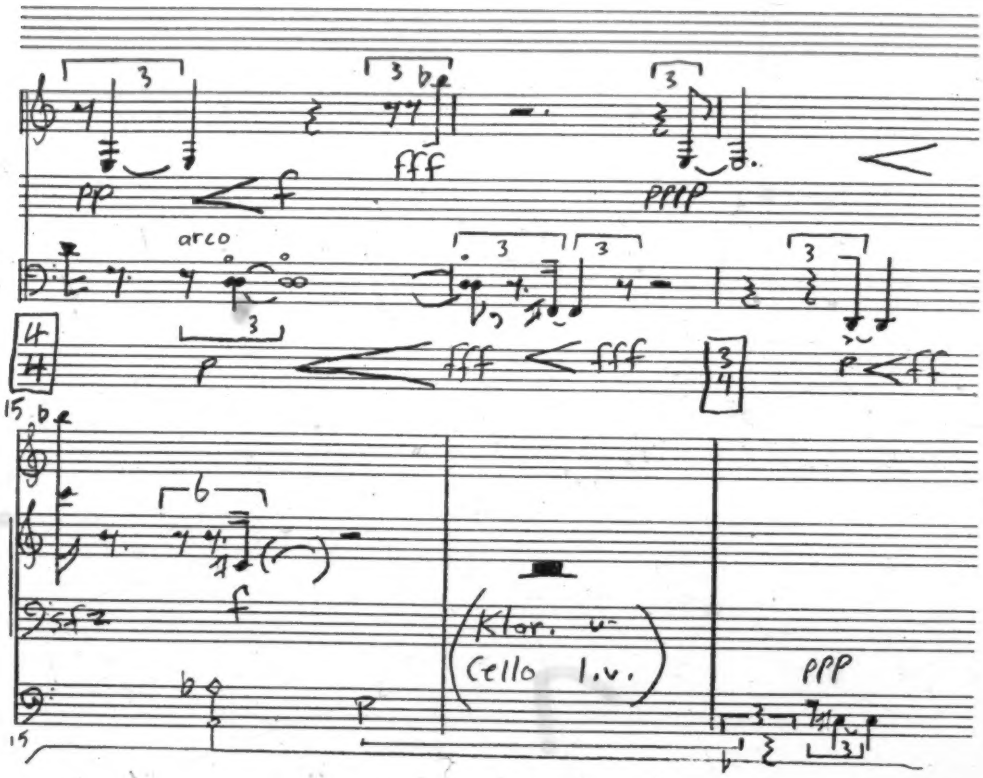
Example 10 shows a different blending of noises. Here the cello plays *col legno*, the clarinet part includes flutter-tongue and slap-tongue and the piano part includes scraping the lower piano strings, plucking piano strings and striking the iron frame (*Rahmen*).



Example 10 Lachenmann, Op. cit., mm. 104-106

The extra effort required from the performers to execute the types of unorthodox instrumental techniques featured in Examples 8 and 9 also serves to expose methods of sound production because the concert experience (another 'aesthetic apparatus') is, in addition to being aural, visual.

Another method of unifying the ensemble is through using the piano as a resonator for all three instruments. For the clarinet and cello this is achieved simply by loud attacks left to resonate in the undampened piano strings. Example 11 shows this.

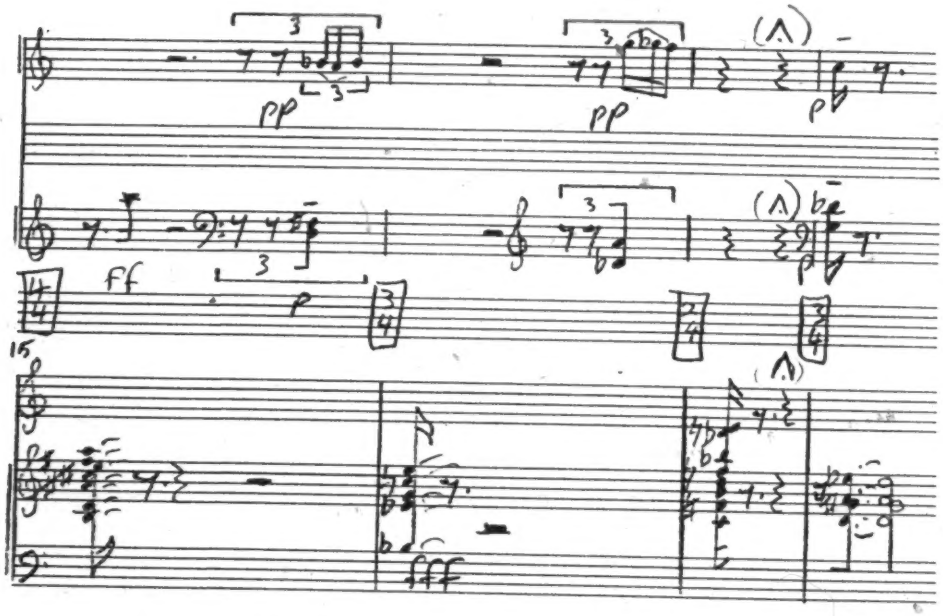


Example 11 Lachenmann, Op. cit., mm. 365-367

Example 11 also displays an attempt at contradicting the piano sound's natural tendency to decay in intensity. This is achieved through one-note crescendi in the cello and clarinet parts. Crescendi also function to give the impression of forward movement, which is part of the discourse of moving from silence to sustained sound.[61]

The "*aura*" and "*archetypal predeterminations*" mentioned above can also be present in musical forms. Lachenmann hints at them while distorting their

characteristics. In example 12, the piano plays on the downbeat while the clarinet and cello, usually in thirds, play on the third part of a triplet rhythm.



Example 12 Lachenmann, Op. cit., *walzer* section, mm. 395-398

This last example is instrumental specificity in terms of the cultural associations instruments carry with them. The instrument's traditional means of sound production and the figurations that are idiomatic for the instrument are used or ignored throughout the work. Out of this use and disuse the structure is created moving from silence-to-noise-to-"sostenuto" pitch. The perception of each instrument`s cultural association depends on the listener's experience and aural memory. Lachenmann's music often has a dramatic quality. Whether or not his verbal polemic contributes to the music's success is debatable, unless one has read Lachenmann's essays or program notes, which also form

part of the listener's experience and associations and further contributes to the aesthetic aparatus.

Conclusion

In the act of composition where a composer begins the abstract process (*écriture*, in French contemporary music circles[62]) he or she sketches on paper in order to visualize the potential sounds. It is impossible to notate timbre fully because it has no measurable continuum and there are too many variables involved. However, timbre can be part of a work's musical fabric through orchestration. This is a partial notation of timbre through instrument specification in the score. Lachenmann's *Allegro Sostenuto* and most instrumental works written before 1945 are examples of this partial notation.

Cage and Tudor recognized that timbre cannot be measured or notated fully. In his realization of *Variations II* Tudor's solution was to measure timbre as either simple or complex.[63] He must find his own description of timbre before he can measure and notate it satisfactorily. But, his realization of Cage's transparencies cannot be seen as a notation of timbre, as they are directions for what actions to take depending on the nature of timbre.

For Murail, timbre must be perceived as generating musical form. Characteristics of timbre form the raw materials for "spectral" music. Notation must be adapted to indicate those characteristics. He points out traditional notation's inability to indicate the full identity of timbre (or sound) but he uses this same notation in his scores. In *Territoires de l'oubli* traditional noteheads relate to the tempered tuning of the piano.

However, in his orchestral works, where instruments are not limited to tempered tuning, pure intervals and microtuning are indicated in the score.

Stockhausen tries to integrate performance instructions and aural perception in his notation for *Mikrophonie I.* The result is practical for performance purposes but cannot be seen as accurate visual representation of timbre. It is clear from the score what timbre is required but words such as "grating" and "brushing" are not exact measurements and leave much to the imagination. Lucier's score is a series of directions on how to uncover a timbre, but the directions are independent from the result. Despite their differences in notational styles, Murail, Stockhausen and Lucier do share (in some of their works) a compositional use of timbre -- structuring a musical work by thinking of sound as a physical phenomenon. Lucier writes, "Thinking of sounds as measurable wavelengths, instead of as high or low musical notes, has changed my whole idea of music from a metaphor to a fact." The tape part of Stockhausen's *Kontakte* (1958-60) consists of sounds created from a pulse generator with a variable and measured frequency control. Similarly to Lucier's concept of "sounds as measurable wavelengths" and, therefore, "facts" rather than "metaphors", Stockhausen measures timbre in frequency and, thus, creates a timbral continuum. This method also blurs the distinction between timbre and rhythm (or duration). If the frequency of a sound is less than a certain number of cycles per second the space between each cycle can be heard and the sound is no longer one sustained pitch but a series of sounds, each with its own duration. This type of evolution can be heard clearly beginning at 17'40'' in the tape part of *Kontakte.*[64]

Viewing sound as a "measurable wavelength" creates another metaphor, albeit different from the high or low musical notes Lucier refers to or the symbolism and affectivity Boulez mentions in reference to Berlioz's *Treatise*. A "measurable wavelength" is a metaphor from the world of science. Moreover, the spectralists' interest in timbre has evolved as a result of scientific study of psychoacoustics, timbre and musical cognition. The partnership of composition and scientific research is in fact one of the objectives of institutes such as IRCAM. Murail is one composer who has worked at that institution.

Seen from the points of view revealed in the words and works of such composers as those discussed above, electroacoustic music might be seen as the most pure and profound attempt at incorporating timbre into structure. In *musique concrète* the composer begins with the concrete (recorded sound) and only after working with the concrete will he or she sketch an abstract global musical structure to aid in seeing the overall work at a glance. This is the opposite of instrumental writing, where one produces the score using abstract visual notation and ends with the concrete in the form of a performance. Such an historic reversal of compositional process is the underlying theme of Francis Dhomont's electroacoustic work *Novars* (1989). The title is taken from the ars nova period of fourteenth century music and the work uses recorded music of Guillaume de Machaut and Pierre Schaeffer (the first *musique concrète* composer) as its original sound sources. Dhomont draws parallels between the invention of *musique concrète* and the original intent of music notation. Symbolic music notation developed initially as a way of permanently recording an aural tradition. Later on composers created

scores first and heard the realizations later in performance.[65] Composers began with the abstract and proceeded towards the concrete. Commenting on electroacoustic music, Dhomont writes that "in acousmatic work the perceived object has priority over the conceived object."[66] He gives the aural facet priority over the written, so that this aesthetic is enabled to contribute to electroacoustic music's integrity as being purely timbral composition. The mere fact that it is not limited by notation has obviated the indirect relationship which has existed hitherto between these two pillars of musical practice (acoustic and electroacoustic) in post-1945 thought.

Notes

[1] Julian Anderson, Notes for Tristan Murail, *Territoires de l'oubli* (Accord 200842, 1991).

[2] Célestin Deliège, *Conversations with Boulez* (London: Eulenburg Books, 1976), 20.

[3] Claudio Monteverdi, *Orfeo*, ed. D. Stevens (London: Novello, 1968).

[4] Silke Leopold, "The Orchestra in Early Opera," trans. I. Zedlacher, *The Musical Quarterly* 80/2 (1996): 266.

[5] John Warrack, *Carl Maria von Weber* (Cambridge: Cambridge University Press, 1976), 221.

[6] Pierre Boulez, "Timbre and Composition -- Timbre and Language," trans. R. Robertson, *Contemporary Music Review*, 2/I (1987): 163.

[7] Hector Berlioz, *Treatise on Instrumentation*, rev. R. Strauss , trans. T. Frat, (New York: Kalmus, 1948), 164.

[8] Ibid, 228.

[9] Ibid, 258.

[10] Richard Wagner, *Lohengrin* (London: E. Eulenburg, 1965).

[11] Arnold Schoenberg, *Theory of Harmony*, trans. R. Carter (Berkeley: University of California Press, 1978), 421.

[12] Richard Strauss, Introduction to Berlioz, *Treatise on Instrumentation*, II.

[13] Theodor Adorno, *In Search of Wagner* (Manchester: NLB, 1981), 72-74.

[14] Claude Debussy, *Letters*, ed. F. Lesure, trans. R. Nichols (London: Faber and Faber, 1987), 75.

[15] Arnold Schoenberg, *Theory of Harmony*, 421.

[16] Carl Dahlhaus, *Schoenberg and the New Music*, trans. D. Puffett and A. Clayton (Cambridge: Cambridge University Press, 1987), 40-41.

[17] Pierre Boulez, *Orientations*, trans. M. Cooper (London: Faber and Faber, 1986), 330-343.

[18] Dominique Jameux, *Pierre Boulez*, trans. Susan Bradshaw (London: Faber and Faber, 1991), and David Gable, "Ramifying Connections: An Interview with Pierre Boulez," *Journal of Musicology* 4/I (1985): 112.

[19] Jean-Charles François, "Organization of Scattered Timbral Qualities: A Look at Edgard Varése's *Ionisation*," *Perspectives of New Music* 29/I (1991): 48-79.

[20] David Schiff, *The Music of Elliot Carter* (London: Eulenburg Books, 1983), 206-207.

[21] Boulez, *Orientations*, 157.

[22] David Osmond-Smith, *Playing on Words: a Guide to Luciano Berio's Sinfonia* (London: Royal Music Association, 1985), 2-3.

[23] François Bayle, "Image-of-sound, or i-sound: Metaphor/metaform," *Contemporary Music Review* 4 (1989): 165.

[24] Paul Badura-Skoda, *Interpreting Bach at the Keyboard*, trans. A. Clayton (Oxford: Clarendon Press, 1993), 98.

[25] Béla Bartók, *Essays*, ed. B. Suchoff (London: Faber and Faber, 1976), 288.

[26] Ernö Lendvai, *The Workshop of Bartók and Kodály* (Budapest: Edition Musica, 1983), 336.

[27] Tristan Murail, "La Révolution des Sons Complexes," *Darmstadt Beitrage* (1984): 77-92. My translation.

[28] Ibid. 84.

[29] Ibid. 79.

[30] Julian Anderson, "Tristan Murail," *Contemporary Composers*, ed. B. Morton and P. Collins (Chicago: St. James Press, 1994), 673.

[31] Tristan Murail, *Territoires de l'oubli* (Paris: Editions Transatlantiques, 1978).

[32] Viviana Moscovich, "French Spectral Music: an Introduction," *Tempo* 200 (1997): 22.

[33] This appears in a simpler manifestation in the *Nocturnes* of Fréderic Chopin and the *Images* of Claude Debussy.

[34] Subscripts indicate position on an standard piano keyboard from bottom to top.

[35] Murail, *La Révolution*, 78.

[36] Béla Bartók, *Out of Doors* (London: Boosey and Hawkes, 1939).

[37] Damiana Bratuz, conversation with author, April 1991. See Gyorgy Ligeti's String Quartet #2 (1968) and Violin Concerto (1995) for other examples of pure intervals interfering with tempered intervals.

[38] Stuart Smith, "Interview with John Cage," *Percussive Notes* 21/3 (1981): 3.

[39] Charles Rosen, "The Piano Music," in *Pierre Boulez A Symposium*, ed. William Glock (London: Eulenberg, 1986), 96-97.

[40] John Cage, *Variations II* (New York: C. F. Peters, 1961).

[41] Ibid. See also James Pritchett, *The Music of John Cage* (Cambridge: Cambridge University Press, 1993), 137.

[42] John Holzaepfel, "Der Tudor Faktor," in *John Cage Anarchic Harmony*, ed. S. Schädler and W. Zimmermann (Frankfurt: Schott, 1992), 51.

[43] David Tudor, John Cage *Variations II* (Columbia MS 7051, 1967).

[44] Jonathan Cott, *Stockhausen: Conversations with the Composer* (New York: Simon and Schuster, 1973), 37. Compare to Lachenmann, *On Structuralism*, (note [50], below) where he writes, "Whatever sound material we use, we are at the same time establishing - consciously or unconsciously - the structures from which this sound or material comes."

[45] Karlheinz Stockhausen, *Stockhausen on Music: Lectures and Interviews* (New York: Marion Boyars, 1989), 100.

[46] Robert Maconie, *The Works of Stockhausen* (London: Clarendon Press, 1995), 151-152.

[47] Karlheinz Stockhausen, "Electronic and Instrumental Music," trans. R. Koenig, *die Reihe* 5 (1961): 61.

[48] Stockhausen, *Stockhausen on Music*, 166.

[49] Robert Maconie, *The Works of Stockhausen*, 120.

[50] Karlheinz Stockhausen, *Mikrophonie I* (London: Universal Edition, 1974).

[51] Robert Maconie, "Stockhausen's *Mikrophonie I*," *Perspectives of New Music* 10/2 (1972): 101.

[52] Charles Taylor, "Sound, §2: Its Nature" *New Grove Dictionary of Music and Musicians*, Vol. 17 (London: Simon and Schuster, 1981), 547.

[53] Alvin Lucier and Douglas Simon, *Chambers* (Middletown, Connecticut: Wesleyan University Press, 1980), 35-36.

[54] Ibid., 30.

[55] Helmut Lachenmann, *Tanzsuite mit Deutschlandlied* (Wiesbaden: Breitkopf and Härtel, 1980).

[56] I am grateful to Heinz Holliger for introducing me to this work, November 1994

[57] Elke Hockings, "Helmut Lachenmann's Concept of Rejection," *Tempo* (1995): 12.

[58] Helmut Lachenmann, "On Structuralism," *Contemporary Music Review* 12 (1995): 93-102.

[59] Lachenmann, *On Structuralism*, 98. In Hockings, "Helmut Lachenmann's Concept of Rejection," 12, 'aura' is synonymous with 'existential aspect'. See also Walter Benjamin, "The Work of Art in the Age of Reproduction," in *Illuminations: Essays and Reflections*, ed. H. Arendt, trans. H. Zohn (New York: Schocken, 1969), 83-109.

[60] Helmut Lachenmann, *Allegro Sostenuto* (Wiesbaden: Breitkopf and Härtel, 1989).

[61] Helmut Lachenmann, Notes for *Helmut Lachenmann, Chamber Music* (CPO 999 102-2, 1992).

[62] In Antoine Bonnet, "Ecriture and perception: on Messagesquiesse by Pierre Boulez," *Contemporary Music Review* 2 (1987): 209, écriture's "meaning includes the act and product of notating one's thoughts as well as a kind of symbolic reasoning - to think a composition starting from the manipulation of abstract and discrete symbols."

[63] John Cage, *For the Birds* (Boston: Marion Boyars, 1983), 128-129.

[64] Karlheinz Stockhausen, *Kontakte* (WER 60 009, 1960).

[65] François Guérin, Notes for *Francis Dhomont: Mouvances - Métaphores* (IMED 9107/08, 1991).

[66] Francis Dhomont, "Acousmatic update," *Contact!* 8/2 (1995): 52.